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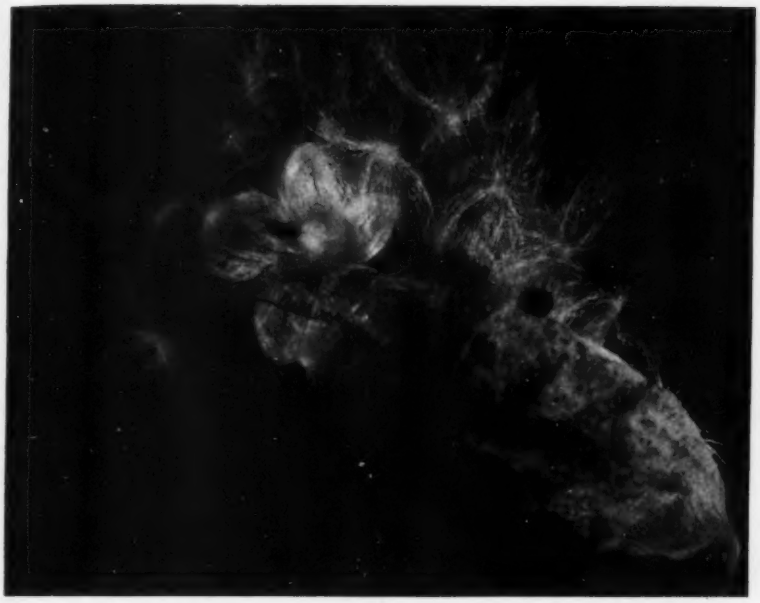
WELLINGTON BRINK
EDITOR



MILKWEED FLOSS for the NAVY

By HARRY A. GUNNING

The substitution of milkweed floss for kapok is only one of the many examples of American ingenuity occasioned by war's necessities. We are proud of the fact that the Soil Conservation Service has been asked to assist in this project. Mr. Gunning heads up the Soil Conservation Service phase of the milkweed-floss assignment. He is Chief of the Nursery Division, Washington, D. C.—THE EDITOR.

With thousands of ocean-going vessels in constant use moving supplies, men, and ammunition to all parts of the world, with naval ships engaging the enemy in the broad expanse of the South Pacific and the Arctic, with submarine warfare in all oceans of the world, and our airplanes moving across large bodies of water to attack enemy posts, each and every man aboard must be provided with the best possible type of life jacket, life preserver, or life raft. Now, a landlubber from the plant world is going to sea as the latest addition to this important rescue squad. Milkweed floss has been tested and found a seaworthy replacement for kapok, long recognized as the most desirable material for the comfortable and widely used "Mae West" life jacket.

At the time of our entry into the war with Japan our supplies of Java kapok were substantial. When importation from Java was halted, allocation of reserve stocks was necessarily restricted to the manufacturer of items essential to the war effort. In the meantime, it was determined that floss from the common milkweed, *Asclepias syriaca*, was equal to kapok and even superior in some particulars. Kapok is a fiber obtained from the seed pod of the *Ceiba pentandra* tree of the tropics. The Ceiba tree is found in Central and South America, Africa, India, and many of the South Sea Islands. Ordinarily, the United States imports some 20 million pounds of kapok annually, chiefly from Java of the Dutch East Indies. In addition to its use in life preservers, it is a material in great demand by furniture, mattress, and pillow manufacturers. The Dutch in Java have developed kapok by plantation management and by improved separation methods into a very superior article especially valuable for flotation purposes. Kapok from other sources generally falls short of specifications in this respect.

Appreciating the increasing seriousness of the kapok situation as the war continued, the War Production Board, with the support of the Army, Navy, Coast Guard, and Air Corps, began to explore the possibilities of supplementing their requirements for buoyant fibers from the native milkweed. The U. S. Department of Agriculture was asked to advise the War Production Board as to the possibilities of milkweed floss collection in the United States. Information assembled by the various Bureaus and by private interests indicated that the common milkweed plant was very prevalent in Michigan, Wisconsin, Minnesota, Indiana, Illinois, Ohio, New York, and the New England States and in the aggregate produced a considerable quantity of floss each year. Thus

1. Home drying in garage. Fences may be used just as satisfactorily, and with less difficulty.

2. Milkweed pods on way to processing plant.

3. Typical of occurrence on stump pasture lands in northwestern Michigan. This picture, made in midsummer 1942, shows growth on fine sandy loam in Emmet County.

4. Natural stand as it is seen along roadsides in Charlevoix County.

encouraged, the War Production Board asked that War Food Administration undertake a 3-year program having as its objective the accumulation of a 10-million-pound stock pile of milkweed floss.

War Food Administration assigned the program to the Commodity Credit Corporation, which in turn requested the Soil Conservation Service to provide technical and physical direction. Two things were made clear to the War Production Board—first, that it was impossible to anticipate with any degree of accuracy the ultimate cost of collecting milkweed floss; second, that it was very difficult to estimate the amount of floss produced annually by native milkweed plants and how much of that floss could be collected through organized effort. The program, therefore, was to be entirely exploratory. In connection with the collection project the Defense Plant Corporation constructed a processing plant at Petoskey, Mich., designed to separate the floss from pods and seed.

Not until August was the Commodity Credit Corporation formally authorized to proceed. As picking operations must start by the middle of

September, the time was short. While the range of the common milkweed includes almost the entire northern half of the United States, its abundance in any given location was completely unknown except for a few counties in northwest Michigan. Of necessity, therefore, the 1943 program was centered around Petoskey, Mich., with the hope that other concentrated areas might soon be found which would lend themselves to organized collection. It was planned, however, to place almost the entire dependence of the current season's operations upon the potential output of the northwest Michigan area.

This area includes the 15 counties bounded on the south by Mason, Lake, and Osceola Counties, on the east by Messaukee, Crawford, Otsego, and Cheboygan Counties, and on the west by Lake Michigan. Here the milkweed plant occurs in relative abundance on the sandy, well drained soils of the abandoned fields, pastures, roadsides, and waste areas. Rather hurried surveys made in 1942 indicated that wild stands in Emmet County alone produce several hundred

1. Milkweed (*Asclepias syriaca*) 2 years from seed; planted by Soil Conservation Service on Research Center, Beltsville, Md. Due to drought, pod production in second year was very light; will produce maximum yield in third year.

2. Soil Conservation Service, Bureau of Plant Industry, and State agricultural experiment station men inspecting milkweed conditions in Emmet County, Mich.

3. An unusually productive individual plant.

4. Close-up of natural stand in northern Michigan. Ready for picking.

thousands pounds of floss annually. While this is recognized as the best milkweed county in northwest Michigan, it is obvious that a very substantial quantity of floss is produced every year within 15 counties under consideration. Assuming these surveys to be reasonably accurate, it did not appear to be an impossible task to meet the request of the War Production Board to build up a substantial stock pile of floss within the 3-year period.

As those familiar with the milkweed plant know, the floss is a very elusive substance. As the plant approaches seasonal maturity the leaves drop, the stem gradually ceases to function and while the pods cling tenaciously to the stem, they lose moisture and shrivel until they split and release the floss and seed. The job on hand was to collect the pods before the floss was lost, dry them so as to retain the desired characteristics of the natural floss and deliver them to the processing plant in good condition for separation.

Several salient points in handling milkweed pods and floss were known and others, for want of factual information, were assumed. On the basis of dry weight, a milkweed pod was known to consist of 22 percent floss, 38.5 percent pod shell, and 39.5 percent seed. Therefore, if separation was perfect, an average of 700 pods would produce one pound of floss. Allowing for certain processing inefficiencies, it was determined that at least 800 pods would have to be collected for each pound of floss. Weight of pods varied greatly. At the beginning of the picking season, pods contained about 66⅔ percent moisture. Moisture content decreased rapidly as maturity advanced, making weight a variable factor. In some instances, 35 pods equaled 1 pound while in others it took 120 pods to make a pound. On an average, there were about 65 pods to the pound.

The difficulties entailed in handling such material were appreciated, and every effort was made to facilitate collection. Even under the best of conditions, the picking season would be all too short. Reason dictated that the collection of pods should not be started until some of the seeds were turning brown. Fifty-pound open mesh onion bags were supplied pickers, so as to avoid the necessity of transferring partially dried pods from one container to another. These onion bags were considered ideal because they would hold a reasonable quantity of pods and at the same time would permit rapid drying. The high moisture content of milkweed pods presented a serious hazard from heating and spoiling. They had to be handled properly. These onion bags have a capacity of 1 bushel, or from 600 to 800 pods. It was, therefore, decided that the unit of measure for milkweed pods would be a 50-pound onion bag, filled reasonably full. For each bag of freshly picked pods the project paid 15 cents; if held and air-dried by the picker, 20 cents. Immediately after picking, the bags of pods must be hung on fences in the open and permitted to dry. Three weeks of reasonably favorable weather would remove sufficient moisture to permit shipment to the processing plant.

Drying bags of pods after collection was not attractive to many persons; not everyone had the necessary facilities to do the job or the desire to bother with that part of it. Wrongly handled, the green pods will heat and spoil very quickly. As a matter of fact, the process is not too exacting; it can be accomplished without much trouble, and with practically no danger of loss, by following a few simple directions. The newness of the program, however, suggested that insofar as possible plans be made to relieve the picker of this responsibility.

It was also appreciated that immediate cash payment for pods would be imperative. The problem was solved by operating through War Hemp Industries, Inc., of Chicago, a private corporation established by the Commodity Credit Corporation for the purpose of facilitating the Government's hemp fiber program. War Hemp Industries, Inc., could make cash payment for all milkweed pods delivered. They could also handle all fiscal transactions of the collection program. Funds for the program, therefore, were assigned to War Hemp Industries, Inc., but management and direction were retained by the Commodity Credit Corporation assisted by the Soil Conservation Service.

The pickers of milkweed pods were expected to be the men, women, and children of the farms. Some participation, too, was anticipated of residents of small towns but it was believed that this would definitely be limited because of transportation difficulties. The peak of the pod harvesting season would normally occur after the haying season and before corn and potato harvest, not normally interfering with normal farm operations. As it happened, however, the current season's irregularities of rainfall and frost did result in some competition with the potato harvest.

The 1943 season in northwest Michigan was abnormal in several ways. The late summer and early fall were exceedingly dry, causing a serious deficiency of soil moisture. Milkweed pod production was quite generally conceded to be materially less than the year before and below the average for the past several years. An unusually early killing frost on September 10 hastened maturity of the pods and

in some locations caused damage to the floss. These circumstances, together with continued dry, windy fall weather, shortened the collecting season from an anticipated 5- or 6-week period to one of about 3 weeks.

The 15 counties of northwest Michigan were divided into 10 collecting areas. A local man was employed to represent the project in each area. He was instructed to find the milkweed fields in his area, to stimulate and encourage collection through farmers, organizations and schools, and to establish centers where empty bags could be obtained by pickers and filled bags of pods delivered. These men were designated disbursing agents of War Hemp Industries, Inc., and were provided with bank account. Each was required to establish a satisfactory number of buying centers within his area to provide a ready market for all pods collected. He was to advance funds to each buying center as needed. In order to handle the fresh pod purchase program a drying yard was established in each of the areas. Trucks made daily or twice-weekly pick-up trips to each of the buying centers, delivering pods to the drying yards where they were immediately hung on fences in the open. In most instances, these drying yards were county fair grounds. In some instances drying yards consisted of well-braced barbed wire fences constructed for the purpose.

Milkweed pod picking was undertaken enthusiastically by a very large number of persons. The results, however, were in direct proportion to the ability to organize an area, provide adequate information, and supply picking bags. Because of the late start, many of the best areas were not able to function until well past the middle of the picking season. In good milkweed stands, individuals picked from three to six or more bags of pods per hour. Forty and fifty bags per day were not unusual, and a few instances were noted in which the pickers earned as much as $1.50 per hour.

Yields varied greatly, as might be expected. Emmet County had approximately 7,000 acres in milkweed. Of this acreage, 350 were classified as good, yielding 38 bags per acre; 1,800 acres medium, yielding 23 bags per acre; 2,700 acres fair, yielding 12 bags per acre; and 2,200 acres poor, yielding 4 bags per acre. The highest yielding field found during the 1943 program produced 80 bags of pods per acre. Harvesting ran in proportion to yield. About 90 percent of the high producing fields were harvested, while only 10 percent of the fair and poor fields were picked. In the aggregate, it was estimated that the season's harvest constituted about 50 percent of the available milkweed pods in Emmet County and from 15 to 25 percent of the production in the other 14 counties of northwest Michigan.

Picking had not progressed very far before we realized it would be impossible to obtain a very great quantity of milkweed floss in northwest Michigan. In the preceding year, there had been a general exodus of the population from this part of the State, estimated to be approximately 25 percent. We immediately began to explore the possibilities of extending our program more widely. Hurried surveys were made covering the entire State of Michigan, a large portion of Wisconsin, and parts of Ohio, New York, Maine, and Massachusetts. Large areas were found where milkweed occurs as a very common plant and in the aggregate might supply substantial quantities of floss, but in no instance did the quantity justify a program similar to that undertaken in northwest Michigan. As Michigan offered as good prospects as any other State, it was decided, because of the lateness of the season, to concentrate the greatest efforts there. Working through the State board of education, the cooperation of the county commissioner of education was obtained. The schools were requested to act as a distribution point for sacks, to encourage the pupils to collect pods, and to assemble the bags of air-dried pods at the school where they could be picked up and the pickers paid. County agricultural agents, county war boards, 4–H Club leaders, American Legion posts and Boy Scout troops all lent a hand.

The results of this effort were not too discouraging, considering the extremely late start. Over 50 counties in Michigan participated in 1943. Ottawa County, with 893 bags of pods, led all others, even though this county did not appear to have a great deal of milkweed. Information and empty bags were supplied to perhaps one-third of the schools of the county, and these schools were able to collect an average of about 15 bags per school. Michigan's school children accounted for the collection of approximately 12,000 bags of pods. It was quite evident that this was only a small percentage of the total production.

As intimated, 1943's collection was somewhat disappointing. We had hoped to obtain as much as 1,000,000 pounds of floss, but the actual figures totaled only some 150,000 pounds. Nearly all of this came from the State of Michigan, with but small quantities being supplied from Utah, Wisconsin, Indiana, Ohio, Maryland, and New Jersey. Better luck in another year is hoped for from the weather and from the ironing out of labor and transportation difficulties.

The need of a buoyant fiber to replace kapok increases as the war with Japan continues. Milkweed floss is at present the only known satisfactory replacement. Consideration is being given to the necessity and desirability of seeding and growing sufficient acreage of milkweed to produce our requirements of floss. Unfortunately, *Asclepias syriaca* is a perennial and will produce no crop the first year from seeding, only a light crop the second, it attains full production the third year. Furthermore, not a great deal is known about the culture of milkweeds and estimates only of potential floss production are available.

In the early 1920's a small amount of experimental work was conducted at Ames, Iowa. Later, the Russians and Canadians conducted some studies, of which we have only fragmentary knowledge. Seemingly, culture of milkweed is not too difficult and good stands would probably produce from 100 to 400 pounds of floss per acre yearly, beginning the second year after seeding. Soil texture, moisture, and rainfall, soil fertility, hydrogen content, cultural practices, and climate—all would have an important bearing. The fact that under normal conditions kapok can be delivered to New York at 10 cents per pound and that milkweed has always been considered a noxious weed and that eradication might eventually be a necessity if it were to be grown as a crop, places present emphasis on an effort to obtain our needs from natural stands of the plant rather than resort to its cultivation.

Knowledge of the natural distribution of milkweed within the United States indicates that it is possible to obtain from 1 to 2 million pounds of floss annually. The experience of the past season shows that its collection can best be accomplished through the efforts of school children. Plans for 1944 are being prepared accordingly. Collections will be organized through New England, New York, Pennsylvania, Ohio, Illinois, Missouri, Iowa, Wisconsin, and Minnesota. The work will be conducted in cooperation with the Extension Service, the War Boards, and the public school systems.

The program gives every school-age child an opportunity to participate in the war effort. It is a worthy and appealing contribution. A continuing and increasing shortage of buoyant fiber for the manufacturing of life jackets could very seriously affect morale. It is enough to risk lives on the battlefields without exposing the fighting forces to unnecessary hazards en route. Only the best and most satisfactory materials should go into the life jackets, life preservers, and life rafts supplied for the protection of soldiers, sailors, and marines. Two million pounds of milkweed floss will make 1,200,000 "Mae West" jackets. That is not too many for the job at hand, but a quantity that will go a long way toward fulfilling this important need.

HE PUT A BLANKET ON HIS ORCHARD

By FRANK B. HARPER and GLENN E. PAXTON

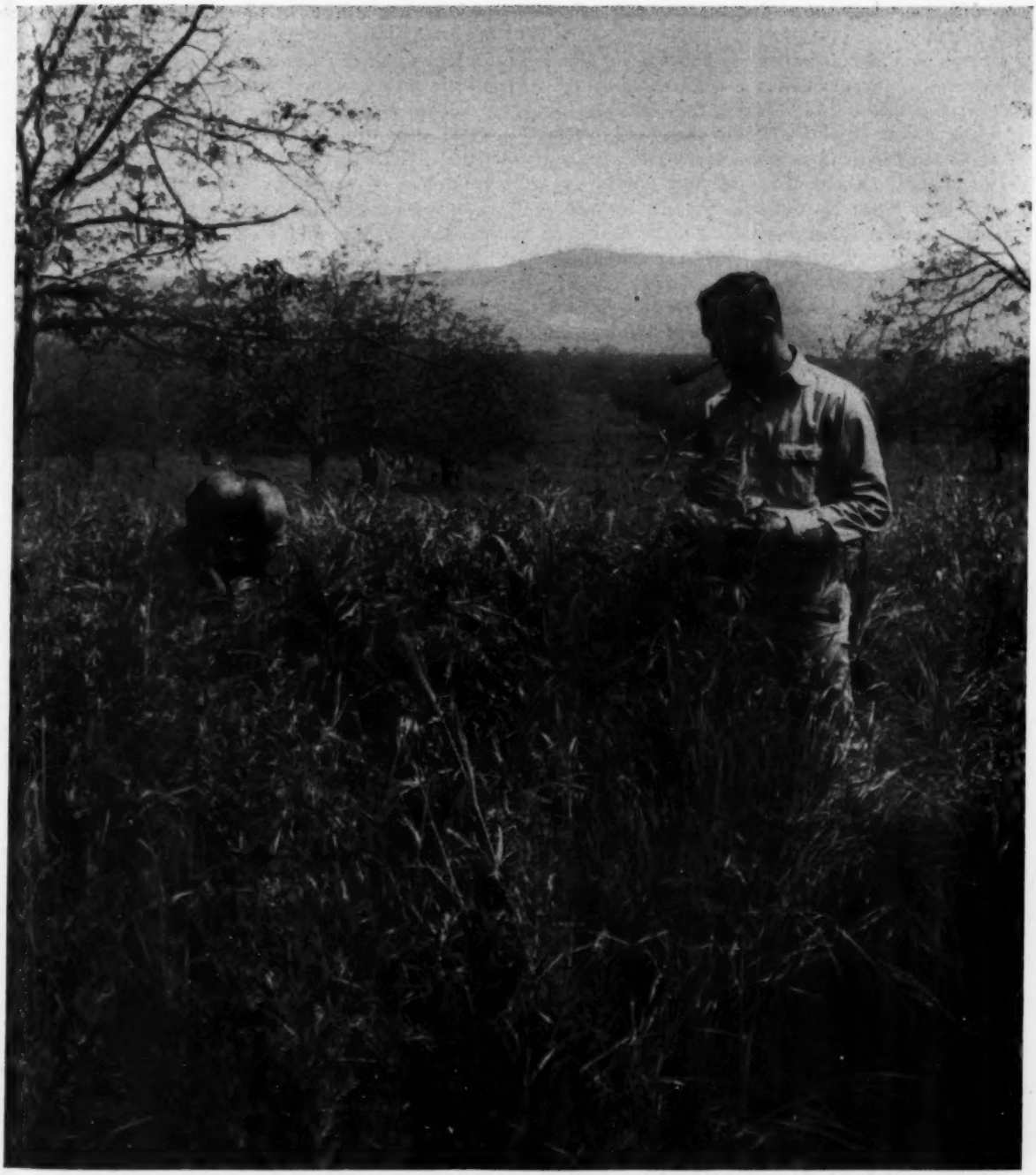
Vanasek works in his specially prepared Victory garden alongside his cover-cropped walnut orchard.

EDITOR'S NOTE.—Mr Harper is of the Division of Information, Pacific Coast Region, Portland, Oreg. Mr. Paxton is District Conservationist, Walnut Creek, Calif.

Several years ago an annual orchard cover crop sold itself to Tomas S. Vanasek, 2 miles northeast of Walnut Creek, Calif., when it stopped soil erosion and cut off two-thirds of the yearly spring disking bill. At the same time, this cover crop restored Vanasek's 25 acres of English walnuts to good producing condition.

Vanasek, who since has become secretary of the board of directors of the Contra Costa Soil Conservation District, admits he became the momentary object of neighborhood humor when he first broke away from the kind of clean cultivation that works the orchard floor down to billard-table smoothness by numerous spring diskings. But he has satisfaction enough today, not only in his own success, but also in the fact that cover crops are doing a similarly effective job on some 3,000 acres of orchards in the district.

Vanasek bought the ranch in 1925. He recalls that he then encountered gullies 18 inches deep and



Annual cover crops such as this one—1943—in Tomas Vanasek's walnut orchard 2 miles northeast of Walnut Creek, Calif., have stopped soil washing, improved condition of trees and quality of nuts, and cut spring tillage costs. Vanasek is at right; Joe Rogers, district work unit leader, at left.

2 feet wide, where earlier operators had run a subsoiler downhill to get water into the soil. In 1926, he said, he disked the ground a half-dozen times or so to kill out native mustard, miner's lettuce and such, "hitching up, and disking the whole orchard if there were even just a few sprigs showings."

His orchard still drew compliments on its neat appearance, but—

"The cover got shorter and shorter, until the ground was bare; and when the rains came, the water

ran off down every wheel track. The quality of the nuts decreased."

Though he did not pretend to know much about soil erosion then, Vanasek and some of his neighbors got together and did the best they could trying to make contour ditches of their own design carry off the runoff without breaking over and washing at the outlets. About 1938, he picked up a suggestion at a Farm Bureau meeting that he take a trip with Farm Advisor Roy Goble of the Extension Service over to Watsonville to look at orchard erosion control work being done there with the assistance of the Soil Conservation Service. Back home, local Service men helped him seed a cover crop of barley, peas, and vetch in the fall. Vanasek got a pretty good barley stand, he says, and the next spring went over it just twice with the disk and did not do any dragging, despite word that filtered back to him about his "sloppy farming." His trees as yet did not look too thrifty, and there were those who thought that his orchard was being ruined.

The Contra Costa walnut grower said he actually did plan once to disk, after all, but one thing and another fortunately kept him from getting at it. Though much of the erosion was stopped by this initial cover crop, water still came down onto the orchard from adjacent high ground. This prompted Vanasek and his neighbors to work out a "real" water-disposal and cover cropping plan, as a unit.

Between December and February of 1940–41 came rains 25 to 30 percent above normal—sometimes as much as an inch a day up to 4 days in a row.

"It was the worst winter we'd ever had," Vanasek reported. "I walked all over the orchard, and for the first time in its history I hadn't lost more than a 10- or 12-quart basketful of soil, contrasted to 50 to 250 tons of topsoil that went off before I went into cover cropping, trashy cover, and water-disposal ditches. And I haven't lost half a yard of soil since. You can't see any evidence whatever of erosion. We have measured 12 to 14 tons of green cover crops to the acre. That holds the water."

Pointing out that one farmer he knows used to go over his orchard eight or nine times but now has reduced his disking to four or five times and possibly will cut it to three, Vanasek said his own two-time disking, with an 8-foot disk and 30-horsepower tractor, is effective. The first time over, he said, kills about 90 percent of the vegetation, even when the disk rides on top half the time; then cross disking a couple of weeks later finishes the kill.

"Our walnuts at the huller, compared with the others, show up as well or better," he said of the nuts harvested by himself and cover-cropping neighbors. "My trees are holding their own now and the quality of the nuts is better. Meanwhile, we are building up the soil; you can pick up a clod and it is full of roots and crumbles up. Before, it was in an unproductive condition."

He was surprised to find that fewer nuts are lost when they drop onto a dry cover-crop mat that flattens down by September, explaining that they bounce and lie on top instead of "plunking" into the fine, loose soil as they once did, "like rain drops." He said that he and Mrs. Vanasek harvested virtually all of their walnuts themselves. On a subsequent spot check, they were able to find in 8 hours only a bucketful apiece of missed nuts under the trees, whereas they retrieved that many in less than an hour on neighboring clean ground.

Purple vetch, Canadian field peas and red oats comprise the bulk of Vanasek's cover crop mixture. It is broadcast 80 pounds to the acre before harvest, right on top of the preceding year's cover-crop mulch. It works its own way down into the soil and thus saves more labor and machinery. Vanasek put at $1.75 an acre, or $77 for two diskings of approximately 22 planted acres, today's cost of handling his walnut land, compared with between $200 and $250 formerly spent for half a dozen diskings in clean cultivating.

His other good land-use practices include annual ditches to carry off excess water, and winter feeding of several hundred birds—principally white crown sparrows, whose liking for his farm wildlife refuge he credits with keeping his trees insect free and saving him a $150 annual spraying bill.

"It's a great feeling," Vanasek says in summary, "to see the black clouds coming up and be able to say, 'Let 'er rain!' "

SAFETY RECORD AT NEW HIGH

For the first year in the history of the Soil Conservation Service's employee safety program, no accidental deaths occurred during 1943. This all-time record established during the past year is particularly enviable, considering the present rapid personnel turn-over and the necessary use of many hurriedly-trained, new employees.

Soil Conservation Service employees' lost time injuries have also been amazingly reduced. From a high of 28 injuries for every million hours worked in 1936 the rate was progressively reduced to a low of 7 injuries in 1943. This means many more workers available in 1943 to push Soil Conservation Service's job of increasing vital wartime food production.

HWAN LUNG SHAN, WHERE CHINA'S HISTORY IS WRITTEN IN THE LAND

By WALTER C. LOWDERMILK

The author, who is Assistant Chief of the Soil Conservation Service, has recently returned from China where he spent a year as agricultural advisor to the Chunking Government.

A former great gully in Hwan Lung Shan that was active during period of intensive cultivation grew up with brush and trees after regional area was abandoned.

In the central part of Shensi Province, west of the Yellow River and east of the Loh, lies the Hwan Lung Shan, or Yellow Dragon Mountains. This area has played a strategic part in Chinese history, because of its location and rugged character. It is said that whatever general held this rugged region was able to march from the west on to Peking. For that reason it has had a new significance in the defense of China against the Japanese; if held by Chinese armies, it would flank any enemy thrust westward along the Wei River to Sian and beyond. This was a good strategic reason for garrisoning Hwan Lung Shan to defend China from further invasion.

But Hwan Lung Shan was nearly empty of people. It had not recovered from the ravages of the Mohammedan Rebellion some 70 to 80 years ago. At that time the villagers were destroyed, the people dispersed, and the farmers driven off their land until this region was practically depopulated. Thereafter it became a harbor for bandits. The ruggedness of the topography made travel through the area slow and difficult and hindered occupation by farm people, especially since pioneers might become victims of bandits that roamed and took refuge in the hills. Colonization of Hwan Lung Shan by refugees from occupied China was undertaken 5 years ago.

Physical features of this region have influenced its history. Hwan Lung Mountains are remnants of a former plateau made up of horizontal beds of alternative sandstones and shales. In past geologic time streams cut intricate patterns into this uplifted plateau, cutting deep valleys with steep slopes and leaving for the most part narrow ridges between. Ridges now stand from 5,000 to 6,000 feet above sea level. We saw ridge after ridge lying remarkably level and at about the same height off to the horizon on all sides. As we traveled from one place to another, we descended a steep slope, crossed a narrow alluvial valley, then ascended a steep slope on the other side. Sometimes, of course, our way followed up or down a valley. Travel by such trains in Hwan Lung Shan is slow. But highways are now being built throughout the region.

Another gully healed. No run-off now occurs. Complete vegetative cover demonstrates that present climate is satisfactory for a fully vegetated landscape.

The original rocks of the plateau are sandstone and beds of shale, alternating, still lying in a horizontal position. The plateau was uplifted and cut into a labyrinth of steep walled valleys before the Ice Age. The loess was deposited as a blanket over this rugged topography during the Ice Age not so thick as to fill in the pre-loess valleys, but to smooth them out. Field evidence indicates that the loess on the steep slopes was eroded during, as well as after, the period of its deposition, and relaid in valley floods. It has been completely removed from steep slopes. Remnants of the old loess blanket were left here and there in the valleys, on the

Hwan Lung Shan—an area with its history written in the land. Upper reaches of drainages were once forested, cultivated, abandoned, and now have grown back to grass or forest. Loess, if it existed on these slopes, has been eroded off.

gentler slopes, and on the wider ridge tops. Primary loess is the original wind-laid material; secondary loess, that which was reworked and water-laid in valleys as alluvium. Wherever the loess is found in sufficient depth, it makes excellent farm land except when lying at steep gradients.

While there is evidence of wide changes in climate from Ice-Age to the present, there is no conclusive evidence of important changes in climate during the past 2,000 years. No meteorological data have been kept. But historical records tell of famines due to drought or floods, inidcating a variability of rainfall that is normal to regions lying between humid and desert zones. Such variability characterizes Western America and the Near East. The physiographic record of the area shows a uniform cutting out of valleys, and would indicate no pronounced shifts in climate.

From natural vegetation rainfall is estimated at about 20 to 25 inches per annum, which falls mostly in summer. The region was originally covered with forest, with grasses on drier ridges and upper slopes. Forest species are pines (*Pinus tabulaformis*, *Pinus Bugeana*), *Sophora spp.*, maples, elm (*Ulmus pumila*), *Zelkova sinica*, and wild fruit trees of peach, pear, and apricot and poplars along streams. Shrub growth includes willows along streams, *Hypophaea*, hawthorne, lilac, honeysuckle, and lespedezas. Herbs and grasses, including wheat and blue grasses, grow on drier sites.

Topography and vegetation mark this as best suited to livestock and forest growing region. Alluvial valley lands and some plateau remnants of loessial soils can be farmed to supplement livestock and timber products.

The region shows the marks of serious misuse in the past. It has partly recovered, healed over by vegetation, since the area was abandoned except for a few isolated subsistence farmers in alluvial valleys. From what is written in the land we read the following record, in five stages.

The first stage dates back more than a century, when this picturesque region was occupied by a farming population that put high pressure upon the land. All the valley floors and the loess caps on the ridges were not only cultivated but the cultivation line was pushed up the slopes to steep gradients, even up to the ridges. Villages were located in large numbers both in the valleys and on the ridges, as we can now see in ruins. How long this period lasted we have no way of knowing without long research. The important fact is that cultivation had been spread to practically all plowable land.

The second stage overlapped the first.—During it there was a marked spread of soil erosion, especially on the slopes, as a result of clearing away the original dense cover and cultivating the slopes. Upper slopes became corrugated and lower slopes were cut with deep vertical-walled gullies. Much of the loess blanket on steeper slopes was removed in this stage, exposing underlying residual material from sandstones and shale. Erosion conditions must have been very serious, judging by marks in the land. Whether or not erosion had developed to this degree before abandonment, or how long it continued afterward, is difficult to know.

The third stage was one of almost complete abandonment by farmers.—This occurred, we are told, during the Mohammedan Rebellions that ravaged the region for some 10 years, between 1860 and 1870. Villages were destroyed and their populations killed or dispersed. These villages were not reoccupied and the region became the haunt of bandits.

In the fourth stage the region was healed of erosion by return of vegetation.—Grasses on hilltops and ridges, and brush and tree growth on lower slopes and wide ridges. Grasses spread over the corrugated upper slopes of the valleys, shrubs and trees grew up in the gullies and on the former fields until the whole surface was covered over with a complete mantle. This was of high significance because it clearly indicated that the present climate will support a vigorous cover of vegetation in this area if given an opportunity. The decline of the area cannot be ascribed to adverse change of climate. Some other cause must be found.

We took occasion to study in detail the vegetation of gullies that had healed. Listed below are the results of a sample plot taken in one of these gullies. The remarkable fact is that no runoff is taking place

under the existing vegetative cover, whereas formerly there must have been a formidable flow sufficient to cut 50 feet deep and from 70 to 80 feet wide. We found gully after gully so healed in the course of our survey. Slopes and tops of broad, rounded ridges were covered with dense stands of birch, aspen, maple, and oak.

We begin, here in Hwan Lung Shan, a demonstration of laying out fields on the exact contour; a bank channel to start a bench terrace. Farmers have come to see the demonstration, and are told objectives and methods of farming measures to save the rain that falls, to store it in the soil, to prevent runoff and erosion.

SAMPLE PLOT IN HEALED GULLY

East facing slope near Yao Hsien. Formerly cut in loess, 56 feet deep, 81 feet wide. Talus on each side covers floor to within 3 feet.

Trees

(Plot 30 feet in diameter laid out in gully):

$\frac{\textit{Salix}}{\text{(Willow)}}$ 4, $\frac{2''\text{–}8''}{6''}$ diameter breast high

$\frac{\textit{Betulas}}{\text{(Birch)}}$ 4, $\frac{2''\text{–}10''}{8''}$ diameter breast high—average 8 inches.

Undergrowth

Acer ginnala
Spiraea pubescens
Prunus sp.
Campylotropsis macrocarpa
Vicia sp.

Herbs and grasses

Carex sp.
Andropogon sp.
Polygonum sp.
Fragmilis communis

Where ridges between deep valleys are wide the loess blanket has persisted and makes excellent farming land. American corn or Indian maize is the mainstay crop of this colonization project in Hwan Lung Shan.

Forest litter of leaves and twigs—6 inches deep, decompositional contact with soil.

No run-off has occurred in this gully for several years, indicating that no erosion has occurred, and the gully is healed up.

Effects of healing of eroding slopes by vegetation was reflected in the regimen of streams. For the the streams were running clear over stones covered with moss that had not been dislodged for many years; willows and streamside vegetation were growing down to the very water's edge, showing that there was very little high stage of flow during the rainy season. The higher stages were not strong enough to wash out channels or to undercut vegetation. We had in these streams a perfect example of headwater control of stream flow, a remarkable fact in the loessial region.

These were evidences of a healing of a seriously eroded region resulting after abandonment. This was especially instructive to us in our study of the problems of the area.

The fifth stage is now in its beginning.—Hwan Lung Shan on the maps appeared to be without people, whereas in former times a considerable population had dwelt here. It was selected as a colonization area for refugees out of Honan and enemy-occupied China. Refugees were invited to come to this region and were assigned small farms where they may grow their food. They were to be exempt from taxes for a period and from military conscription. But they were to train for guerrilla tactics as a defense against the invader.

Valley floors were cleared and cultivated, the loessial cappings of border ridges as well, but now formerly fields on slopes are being cleared again and cultivated to food crops. Clearing slopes again

has set in motion the beginning of another cycle of accelerated erosion. We were called in to advise on suggestions for development of the region.

We talked to refugees, some on the trek, others that were settled on a piece of land where a remnant of the loess blanket stood as a cliff into which these people could hew out caves for a home for themselves and a stable for their work cow. One family, Mah by name, had fled because the Yellow River flooded and now flows over their land; 1 family, Wang, a fine group, now living in caves, are cultivating 7 acres of land to corn, potatoes, onions, and millet. They had fled the Japs who invaded the Hopeh area. The Wangs had had a big farm in Hopeh, with 100 pear trees, and were prosperous farmers. The old man and his wife were proud people. Their 3 stalwart sons were fine specimens of the determination of China to remain free. Another refugee family by the name of Li had stopped for lunch in the shade of trees beside a clear flowing stream and were making wheat and corn bread dough for their noon meal as we pased by. These were from Hupeh, where the Japs had invaded, and had fled the robberies and cruelties of the Japs to be free. It was the spirit of these people that moved me. I took pictures of many of the refugees, cheered them, wished them happiness and wealth and good luck, by saying "How Fu Chi." The Wang family invited us to have lunch, for which, of course, we paid them well. They gave us millet instead of rice, wild celery, the fresh green leaves of trees, onion tops, and boiled eggs. Chopsticks were cut from slender stems of bushes nearby. It was a good meal and a cheerful one. Hospitality of these proud people was very real, and dignified. There is a great story—a Good Earth story up to date in these refugees and their search for a way to live on. The dark, tragic, side of the story is that not hundreds, not thousands, but millions have died, many of starvation, many of diseases aided and abetted by malnutrition. This great drama of people fleeing the invader and seeking to find an adjustment to resources of the land is the most fascinating drama of reality. Uprooting of people, making them seek out new adjustments, only brings into bold relief the fundamental—the basic—the foundation factors of such adjustments that our complex society obscures from the general perception. If we are to establish peace, a constructive peace on earth, we must understand how the mechanism of civilization works and see that this mechanism is well constructed and well tended.

After making a study of the area, we put in at Si Pu a demonstration of conservation measures for the farmers of the neighborhood to see. The village itself lies in the valley along the stream. But the best farming land is up on the remnant of the old plateau, which near here has not been cut into by stream erosion. This plateau remnant is covered with a blanket of loess which makes it fertile farming land. One of my men, Tsiang Teh Chih, had surveyed this area some 10 years ago to make a report on its possibilities for colonization. He told me that then he had found this tract in tall grass with a scattering of wild pear trees. But now the entire area had been cleared and was cultivated to corn and potatoes. Already the heavy rains had begun to course across the gentle slopes and to erode the soil into shallow rills. Considerable streams of storm run-off had accumulated from the larger fields and poured off again into the heads of healed up gullies dating back to the former period of accelerated erosion. Here was a chance to put conservation into farming of this area.

Farmers in this area had come principally from Honan. They were not at all accustomed to farming sloping land, for the great delta of the Yellow River at Honan is practically level. Their rows were straight and they took no account of topography or of contour farming. Our first measure, then, was to begin to lay out fields on exact contours, beginning on the gently sloping divides on the remnant of the plateau. We had made our plans a few days before, had made **A** frames and **V** drags, and had assembled plows and surveying instruments to lay out the fields on the contour, to build broad-base terraces and to sow strip crops to show the farmers what we were driving at.

When all was in readiness, we followed the steep trail out of the valley on to the plateau and came to our location. As we began to plan fields and to stake off our contour lines farmers began to gather. Soon we had 75 to 80 farmers to see what we were doing. Each member of my party had his task. Engineers laid out lines, and the agronomist talked to the farmers. While we were plowing a terrace location and using the **V** drag we noticed a cloud of dust off in the distance. Presently we could see a great crowd of people coming. They appeared to be in a hurry. Soon fully 300 farmers came to see our demonstration. They watched as we put in the measures to absorb more of the rain and to reduce the run-off and erosion, and answered questions of our agronomist.

Director Hu of the colonization project was anxious that farmers pay close attention and became thoroughly acquainted with our work. For he declared his intention that rules for farming the land

assigned to refugees should follow the principles of conservation.

In this region we found an excellent set-up for an experimental demonstration to include complete drainage. The upper portions of the drainage would be a part of the plateau loess cap and a great gully which had eaten back into it in the second or erosion stage. At present this great gully is filled with trees and furnishes an excellent woodlot to supply fuel and timber for nearby villages. Some portion of the gully floor must be built up by means of a soil-saving dam to catch silt that erodes from the drainage before a complete program of conservation measures can fully check erosion. This alluvium will make additional land for farm fields. Intermediate slopes of the gully are now covered with brush but may be partially cleared and reseeded to grasses for excellent pasture.

In this area we had the opportunity to establish an experimental demonstration project wherein we may classify the land according to its highest sustained uses and develop each class for farm crops, forage cover for livestock and woodlots to supply the local people with livestock, timber and food products. We recommended that this tract be set aside for a large experimental demonstration to represent the problem area of the Lo Ho drainage. Since land is not yet deeded to refugees, it is possible here to rearrange field and farm boundaries to fit into a program of conservation treatment of all classes of the area's land.

As Indian maize, a New World crop, was the food crop of our pioneers of America, so is corn the food crop of these pioneer colonies in Hwan Lung Shan. Corn, potatoes, and hemp are the principal crops grown. The region is a bit too high for winter wheat. Oats or spring wheat or buckwheat may be grown and the people from Honan prefer wheat, but thus far corn has proved to be the most easily planted and tended, and gives the largest returns to the farmers.

As we left our demonstrations we passed many refugees along the trail. I was touched by the greeting of one farmer, Ko, whom I recognized as one who had taken part in our demonstration of the day before. He was most sincere and eager that I get off my horse and have breakfast with him; he wanted to talk to me. I apologized by saying that I spoke Chinese poorly. In reply he said, "You speak very well," and was very insistent on my getting down to have breakfast with him. But Director Hu said that we must be going on to reach our lodging for the night. Along the way farmers were clearing land now in brush, grass, or trees. More of this was being done along the broad ridge than I had seen elsewhere. Beside the trail were fields already planted to corn, potatoes, hemp, and buckwheat.

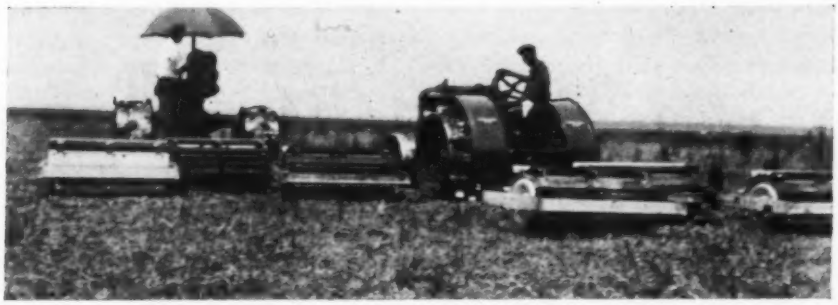
All along the way were old gullies, now healed up but bearing marks of devastating erosion of some time in the past before the region was abandoned. We passed on to a divide along a high broad ridge. From this divide we got magnificent views out toward the deeply dissected country to the east, that went from green foreground to blue on the horizon. I took colored photographs, but people will be hard to convince that this, too, is China. Guards saluted us all along the way.

At our headquarters on the morning of our departure I was invited to speak to a great crowd of farmers, most of whom had been standing there since 6 o'clock in the morning. Each farmer had a paper flag in red with characters written on it and these they waved in applause. They listened with attention to what I had to say as it was interpreted to them in Chinese, for my Chinese is not good enough for making a speech. As we drove away, farmers stood on each side of the road for more than half a mile and cheered and waved their flags to send us off.

We had spent 16 days in a region the like of which I had never seen before in China, a region which bears a record in the land that we found not only interesting but instructive, as well, in indicating measures that should be recommended for improving the use and productivity of this strategic area of Free China. Most important of all, we had found evidence that decline of this region, as shown by ruins of abandoned villages, was due to misuse of the land rather than a climatic change. Such misuse may have brought on social disturbances that ended in the Mohammed Rebellion. Moreover, prevailing climate is favorable to healing land wounds of erosion and to conservation use of this picturesque and strategic area of north China.

For almost a year, the Service has been engaged in a survey and analysis of the soil and water conservation needs of the Nation. This undertaking, which is now nearing completion, will provide a factual, physical analysis of the land resources of the country, indicating what conservation measures need to be applied, and to what extent, if we are to achieve maximum efficiency and full productive use of our soil wealth.

BLITZING THE BRUSH IN FLORIDA



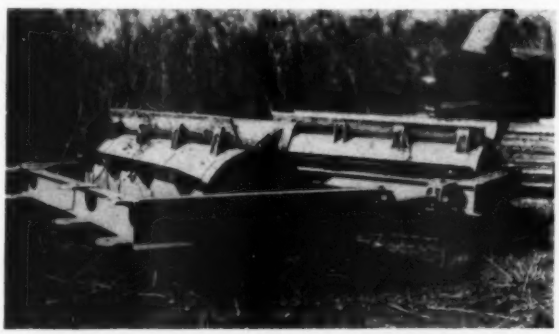
Three-unit machines pile up the weed-free acreage as wheel-type tractors romp along in high gear. Five- and seven-unit machines of the same type cut acres in astronomical figures, as compared with other and older ways of eliminating weeds.

By J. E. WILLIAMS

From Florida, a State with nearly a million head of cattle, comes a machine designed especially for the establishment and maintenance of pastures. The term "establishment" includes the eradication of brush and other undesirable growth, together with the preparation of a seedbed suitable for planting grass seed in one operation. "Maintenance" has to do with the elimination of weeds, which are sure to follow the planting of grasses, the elimination of any sprouts which might come up from the previous foreign growth, and a mild cultivation of the newly planted grassland.

The largest of the machines comprises two units, each 7 feet wide and weighing 4,500 pounds. The machine is a hollow steel drum around which are bolted blades much in the manner of the old stalk cutter. This drum is filled with water, which approximately doubles the weight and brings the 2-unit machine of this size to 18,000 pounds. Maximum cutting ability is obtained through hitching the 2-units in tandem, with a semirigid connecting link forcing the rear unit to follow the first at an oblique angle. Operated in this way, this large machine very effectively cuts brush, palmetto, bay, oak, and pine. The action is such that the rubbish is cut *into* the soil without inversion. In other words, the fertile topsoil is left in place and in such condition that grass seed can be planted without further operations.

This largest of the machines requires considerable power, though not as much as might be anticipated. Crawler type tractors of the medium range of horsepower are sufficient. A slightly smaller machine, having units of 5-foot spread instead of 7, are handled with ease by tractors of the WD–40 or TD–40 class, or by Caterpillar RD–4's.



A large version of the cutter, hitched so that the two sections are in tandem. Known as a "light brush cutter," it makes short work of brush such as that shown in background. A still heavier machine of identical type weighs 9,000 pounds and will cut pine trees up to 5 inches in diameter. Foreign matter is cut into the soil, leaving a seed bed ready for planting.

On pre-war basis of availability of grass seed and other conditions, land could be prepared and planted for an average of $5.00 per acre. Where the foreign growth was not so heavy the cost might be considerably less.

Much of Florida's range land consists of vast prairies, free of timber and sodded with the native carpet grass growing either naturally or as a result of having been planted following the removal of palmetto. Here, weed control is the problem. Mowing is calculated by the Florida rancher as too slow and too expensive. Hence the cutter has been adapted for the work. A much smaller machine of the same type is used, only that each individual unit is hitched so that it follows parallel to, and at an off-set, to the lead

(*Continued on page 213*)

EDITOR'S NOTE.—The author is co-owner of the Crescent Valley ranch, Davenport, Fla., with his father, P. E. Williams. Williams, Sr., is president of the State Cattleman's Assn.

SNEAKING UP ON WEEDS

By RICHARD M. BOND AND PAUL M. SCHEFFER

Weeds are familiar saboteurs of war food production that invite soil conservationists to draw upon their best land use improvement techniques to help with a problem that is annoying and wasteful at any time.

When weed-infested lands are added up—from patches of morning glory the size of a hat to whole fields or entire farms gone back to sunflowers, ragweeds, and the like—there is a vast area producing nothing but weeds, and an even greater acreage that has so many weeds mixed with crops that both production and quality are lowered. Even without a war, weeds are no help to the farmer who is trying to make a living from his land. Rather, they are too often associated with "run down" land, overgrazed ranges, eroded hillsides, or other results of improper land use.

Although weeds, like beneficial plants, grow best in rich soil with favorable climate and moisture, under these conditions the crop plants are usually able to crowd out most of the weeds, whereas in poor or raw soil low in plant nutrients and organic matter the weeds do much better than the crop plants.

Of course, there are many places where sagebrush or cactus or Russian thistles or sunflowers have played an important part in holding misused soil until better plants have been re-established, but sometimes conditions on a piece of land get so bad that even weeds cannot take it.

Wesley Cornwall, chairman of the board of supervisors of the Latah Rock Creek Soil Conservation District in eastern Washington, remarked last fall in discounting dry-pea farmers' excuses for burning their straw because that "would destroy weed seed." "There are just two answers to this weed question—you either have to build up the fertility of your soil until you get good crops and also weeds; or let the land run down till you don't raise either one." Even though peas do not compete with weeds as well as most other crops do, it was noted that right in Mr. Cornwall's neighborhood fertile soil in peas actually harbored fewer weeds than run-down soil, although the difference was not so marked as to catch Mr. Cornwall's eye. He was watching the peas, and there is no question that fertile soil produced more of them.

Probably the weed problem is not at its worst in any particular place, but it is certainly extremely serious in many parts of the Pacific Coast Region, especially in many of the irrigated valleys where hot, sunny weather and ample moisture promote luxuriant growth of crops and weeds alike, and where the weeds are so widely distributed that complete eradication appears hopeless. Because of the need for wartime farm production, and because it is so intimately associated with good land use, the weed problem is receiving much attention from Soil Conservation Service biologists, agronomists, and range men. Field observation on various methods of land management have been valuable, and State publications contain material that can be adapted directly to fit into the soil conservation program. The ultimate aim is to gather together the facts about each type of weed, each kind of agriculture, and each class of soil and climate. Eventually it is hoped to develop for each soil conservation district a set of simple job sheets for weed control by management exactly fitted to local conditions. This already has been done on the Wenas District in central Washington.

Weeds do not grow on a farm because they are naturally mean, nor because they are in the pay of the Axis. An Oregon oat field full of Canada thistle or a Missouri meadow full of daisies is not that way

Two irrigation ditches in Yakima Valley, eastern Washington. One has its banks covered with whitetop, the roots of which push out many feet into the fields each year and the seed of which is shed into the irrigation water. Banks of the other ditch have been planted to perennial grasses, and the whitetop that was there too has been so thoroughly suppressed that it does not show in the picture and is no longer a serious pest. The grass provides useful forage.

EDITOR'S NOTE.—The authors are, respectively, chief regional biology division, Portland, Oreg., and associate biologist, Yakima, Wash.

Two irrigated ladino clover pastures in the Sacramento Valley, Calif. The cow pasture has been regularly clipped and is free of weeds. The sheep pasture has not been clipped and the weeds are getting ahead of the clover. Forage production in the weedy pasture has been lowered by an important amount.

because "somebody introduced the seed" into the area. Those particular weeds would not have been there if their seed had not been introduced, but there would be other weeds just about as bad.

Weeds grow where they do for a very simple reason that is not widely known. It is because they are the plants among those available that are best suited to succeed under the particular climatic, soil or other conditions present. In other words, the hayfield is full of daisies because conditions there are better for daisies than they are for clover, timothy or whatever the farmer is trying to grow.

It may be because they get so angry at them that many farmers try to get rid of their weeds by means of a violent frontal attack—2 or even 3 years of clean cultivation, or 5 pounds of chlorate to the square rod, or even by burning with a torch. Yet some thought and observation will show that, in a great many cases, it is much better to sneak up on the weeds and take them from the rear.

"Direct" weed control of various kinds has killed its share of weeds, it is true; but direct methods have a number of drawbacks. They are expensive, they usually take the land out of production for several years, and they must be used with great care or they are worthless. Many a time the missing of one cultivation has set the weed control program back a whole year. But worst of all, the soil usually is left in poor condition for crops, and in virtually perfect condition for the weed to move right back in and take over the place. This is especially likely to happen when the farmer resumes his old farming methods which encouraged the weeds in the first place, and if the weed in question has been established a long time, is on the neighboring farms, and already has seeds in the soil that will sprout for years to come.

Sneaking up on the weeds, however, is practicable in almost all parts of the country. On every sort of land there are one or more factors of environment that can be changed so that conditions can be made so favorable for various valuable plants that weeds cannot compete successfully.

One of the most widely effective weed control methods is a crop rotation that includes a green manure crop. People usually do not think of this as a weed control practice—but just compare the weeds in one-crop land and in adjacent land under a good rotation. In a one-crop system, any plant that sprouts a little later than the crop and matures a little earlier is an especially dangerous potential weed, and such plants tend to become more and more abundant as the years in a single crop go on.

A series of different crops, seeded and harvested at different times of the year, does not allow any such weed population to build up. Furthermore, weeds are usually worst in land of low fertility, simply because many of them are able to make better use of very small amounts of plant nutrients than are most crops. A green manure crop increases the supply of plant food, and creates conditions under which crop plants grow more vigorously than do most weeds. Chemical fertilizers have a similar effect, but seemingly to a lesser degree, perhaps because the physical condition of the soil is improved by the added organic matter but not by the chemicals. Again, many of our worst weeds have coarse tap roots better adapted to growth in soils low in organic matter than the finer, more fibrous roots of most of our crop plants.

Perennial grasses and legumes often will grow well where other crop plants grow poorly. It is better to have a good hay field than a field containing 90 percent bindweed and only 10 percent potatoes.

Weeds in hay and pasture fields of legumes are often a symptom of too much nitrogen for the available phosphate, or of too little lime. Weeds in pastures of grass, or mainly grass, quickly become abundant if the pasture is misused. If the cattle are turned in when the ground is wet, the soil is compacted and the sod becomes cut and broken—the very conditions most suitable for mayweed (called dogfennel in the West) and many other weeds to get a good start. Grazing animals eat the tastiest food they can find, and so take the forage plants and leave the weeds to grow. As the weeds

grow taller, they begin to shade out the pasture plants and thus make room for more weeds.

That is why so many farmers—though not enough of them—clip their pastures a couple of times a year. This treatment forces the weeds to compete on even terms with the grazed down grasses and clover, and proper fertilizing and proper grazing assures that the weeds lose out under these conditions. Regular pasture clipping is important everywhere, but especially so in areas that formerly were forested, because there brush and trees will quickly reoccupy the land if they are allowed to do so. (Of course the pasture plants have to be suited to the soil, moisture, and climatic conditions—no amount of management would keep weeds out of alfalfa seeded on land with a high and fluctuating water table, for example.)

Road banks and field borders are liable to excessive weediness, and though their production of vast quantities of weed seeds is probably not so dangerous as usually thought, these seeds do not *help* the farmers keep the weeds out of his crop. More important is the fact that the weeds are worthless, and land in weeds is not providing anything for the farmer. Weeds grow in such places because the land there is especially subject to disturbance and erosion. There are not too many useful plants that can grow in such places and keep the weeds out, but sericea lespedeza in the southeast and Ladak alfalfa with crested wheatgrass in the northwest will do it, and are doing it—and providing hay, pasture, erosion control, and wildlife food and cover, to boot.

In irrigated sections of the West, weeds often take over the ditch banks and produce seeds which float down the ditches and into the crop fields with the irrigation water. Those same ditch banks will support excellent stands of harmless or even useful plants. In the Pahranagat Soil Conservation District in Nevada, there is a ditch with the banks grown up so solidly to quailbush (*Atriplex lentiformis*) that crop weed and willows alike are kept out. This happened naturally, but in the Ahtanum District in Washington, a farmer rid his land of a serious infestation of white top (perennial peppergrass) by seeding down his irrigation ditch banks to a mixture of orchard grass and Kentucky bluegrass. The grass is grazed lightly along with the aftermath in the field, and in that way provides a return as well as keeps out the weeds. Southernwood (*Artemesia abrotanum*) shows great promise for weed control on the dryer banks of main irrigation canals in some parts of the country, and is being given careful trials where undesirable plants have become established.

Where good use can be found for its nutritious tubers and tops, Jerusalem artichoke can be used to eradicate quackgrass, according to USDA Technical Bulletin No. 33. This publication also gives simple directions for eradicating the Jerusalem artichoke, which quickly succumbs to clipping at just the right season of the year.

Two ways to control roadside weeds. Both are effective, but the burning (Lewis County, Idaho) is expensive, and must be repeated annually. From the other roadside (near Davenport, Wash.) the farmer has recently cut a good hay crop of smooth brome grass. The road district in the Latah-Rock Creek Soil Conservation District in eastern Washington has graded miles of roadside for farmers to raise hay, because the hay provides permanent control of weeds and erosion.

Whatever the local weed problem, soil conservation district farmers, assisted by Soil Conservation Service men working closely, in turn, with the Bureau of Plant Industry and other federal and state weed control authorities, are bringing good land use practices effectively to bear upon the situation and at the same time boosting war food production and farm income.

> Soil conservation is not just an incidental bit of the mechanics of farming; it becomes an essential part of the whole business of making a living from the land, and is the only way by which we may have permanently productive land for a permanent agriculture for continuing support of the Nation.

WATER WILLOWS FOR SHORELINE EROSION CONTROL IN FARM PONDS

By HORACE J. HARPER

Water willow protecting shore line of dam on R. E. Hoy farm northwest of Covington, Okla., 1943. Bermuda grass safeguards upper part of dam.

Farm ponds are an important source of water for livestock in the southern part of the Great Plains region. Severe drouths in 1934 and 1936 convinced many farmers in this area that larger and deeper ponds are needed. During the past 4 years more than 23,000 farm ponds have been constructed in Oklahoma. Generally speaking, the larger the pond the greater the wave action on the shore. The character of the soil material and exposure to prevailing winds are important factors affecting the rate of bank erosion. Where rock can be readily obtained, a dam can be riprapped for a few feet below and above the spillway level to protect the structure from wave action, but the cost is high. In many areas, no stones are available and under such conditions bank erosion may be a serious problem.

One of the difficult problems of protecting a shoreline from wave action with vegetation is to obtain a plant which will grow in the water and also grow on the land. The rate of evaporation in the Great Plains area is very high during the summertime and runoff is frequently very low. It is not unusual for the water line to recede 50 to 200 feet horizontally with a lowering of 3 or 4 feet vertically. Few plants can live under such conditions. Many plants will grow in water but die as the water line recedes during periods of drouth. Other plants will grow along the water's edge but are killed if partially submerged. Vegetation such as cattail, rushes, smartweed and arrowhead require a fertile soil to produce a vigorous vegetative growth. These plants also prefer to grow in protected areas.

EDITOR'S NOTE.—The author is professor of soils, Oklahoma Agricultural Experiment Station, Stillwater, Okla.

The American lotus is objectionable because it will grow in very deep water and completely cover the average pond in a few seasons. Primrose willow (*Jussiaea diffusa*) will grow in very poor soil and will live on an exposed shoreline but it is not effective in controlling strong wave action on exposed locations where there are high winds because it grows on the surface of the water and anchors its roots near the shore.

A technical bulletin entitled "Larger Aquatic Plants of Oklahoma With Special Reference to Their Value as Fish Culture" by James deGruchy was published by the Oklahoma Agricultural Experiment Station in 1938. In this publication the author mentioned the drouth-resisting character of water willow and its value in the clarification of muddy water. Several plants were transferred to one of the fish hatcheries near Lake Carl Blackwell, 6 miles west of Stillwater, Okla. This hatchery was drained in 1942 and 1943, but the water willow maintained a dominant cover on the bank in competition with annual weeds during this period. Since the water willow will grow either in or out of the water, it has two requirements which are important in the control of shoreline erosion in farm ponds in this region.

Water willows were planted in two ponds near Covington, Okla., during the first week in July, 1941. At one of these ponds the dam had been severely impaired as a result of wave action. In the other pond, not very much damage had occurred. These plants made a good growth during the summer and fall of 1941 and an excellent growth in 1942. In 1943 a dense growth of vegetation protected the

shorelines along these dams from wave action where the water willow had been planted.

A picture showing the development of water willow along the shoreline of a dam 2.5 miles north and 0.5 mile west of Covington, Okla., is presented on page 212. Bermuda grass had developed a dense sod on the upper portion of the dam but it did not protect the shoreline from undercutting by wave action. A small area of eroding shoreline which is not protected by the water willow will be observed in the right side of the photograph.

The water willow reaches about 2 feet above the water and has a small blue flower. It is an herbaceous perennial with willow-like leaves and a pithy stem. It grows in a wide range of soils, from moderately acid to basic; and makes a good growth on soils low in natural fertility. Since water willow does not grow in water much deeper than two feet, it does not clog the pond as do some other aquatic plants. Because water willows occasionally become a problem in shallow water, they are often best used on steeply sloping shores. Livestock grazes upon the water willow in the summer when the grass is no longer succulent. This is not particularly objectionable although it may reduce the vigor of the plant. Fencing the pond prevents such damage, and is worthwhile for other reasons. According to deGruchy, more fish have been produced in Oklahoma hatcheries when water willows were planted in them than in hatchery ponds where other types of aquatic vegetation were growing. The production of large numbers of small fish is not desirable in farm ponds where fish are to be managed for food, and farm ponds having water willow will therefore be more difficult to handle for fish production. Waterfowl, on the other hand, make some use of the plant for food and shelter.

Individuals who are interested in securing water willow can obtain this plant at several different locations in eastern Oklahoma. Some of these locations are as follows:

Mohawk Park, Tulsa County
Mountain Fork River, McCurtain County
Reynolds Lake, Northern Atoka County
Dow Lake, Eastern Pittsburg County
North of Perry, Noble County
Fish Hatchery 6 mi. west of Stillwater, Payne County
2½ mi. N. and ½ mi. W. of Covington, Garfield County
Lost Lake and Medicine Creek, Comanche County

It is important to have vegetation not only along the dam, but also on all parts of a shoreline where soil or soil material is in contact with the water to control wave action. Muddy water occurs in many ponds which would be clear if wave action could be controlled. In other ponds the calcium content of the water is not high enough to coagulate the clay particles, consequently new ponds may not clear until the accumulation of organic matter along the shoreline will increase the calcium concentration in the water to a point where the clay particles will be aggregated and settle to the bottom. When a pond is newly constructed, frequently the fertility in the soil material along the shoreline is very low. It would be desirable, under such conditions, to fertilize the area in which vegetation will be planted to obtain a more rapid growth.

(*Continued from page 208*)

unit. The individual unit width of these smaller machines is 4 feet, so that a machine of 2 units cuts a path 8 feet wide. On the larger pastures in Florida machines of 5 units are used, and in Texas, on the vast expanses of the King ranch, machines of 7 units, cutting weeds and sprouts in a path 28 feet wide, have put the mower to shame as a weed cutter.

Designed by a specialist in the grove and pasture problems of Florida, the cutter described has been adapted to many uses, ranging from the cutting of cover crops in orange groves to the cutting of impenitrable brush lands for the ever-expanding pasture improvement program.

Ten years of action for soil conservation—10 years of hard, unremitting work on the part of men and women imbued with an almost evangelical love for the land—have profoundly changed the situation from that which prevailed in 1928. Today farmers throughout the country do know about terracing, and also about the many other soil conservation measures and techniques which are protecting so much good land and bringing back into use so much of our damaged land.

SOIL CONSERVATION

CLAUDE R. WICKARD
SECRETARY OF AGRICULTURE

HUGH H. BENNETT
CHIEF, SOIL CONSERVATION SERVICE

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MUD BURIES THE PEARLS OF HAWAII

By E. H. BEACH

Of possible interest to the true conservationist is the story of what happened to the pearls of Pearl Harbor. As the Old Hawaiians had no written language, ascertaining the past history of the islands is a very difficult task. About the only records available are the logs of ships which passed through the "Sandwich Islands" in the old days, and the accounts of old residents who lived after the English language was introduced.

Several of these logs mentioned the fact that what was then called "Pearl River" received its name from the fact that it contained pearl oysters. One of these early voyagers was Lt. Hiram Paulding of the United States Navy, who visited the islands in 1826 on board the *Dolphin*.

By far the best account, however, was written by Sereno E. Bishop, who was born on the Island of Hawaii in 1827. He was noted as a scientist and a naturalist, and was the discoverer of "Bishop rings" around the earth after the eruption of Karakatoa in 1883. In his reminiscences, written in 1901, he gives the following account:

"The lochs or lagoons of Pearl River (Pearl Harbor) were not then (1830) as shoal as now. The subsequent occupation of the uplands by cattle denuded the country of herbage and caused vast quantities of earth to be washed down by storms into the lagoons, shoaling the water for a long distance seaward. No doubt the area of deep water and anchorage has been greatly diminished. In the thirties the small pearl oyster was quite abundant and common on our table. Small pearls were frequently found in them. No doubt the copious inflow of fresh water favored their presence. I think they have become almost entirely extinct, drowned by the mud. There was also at Pearl River a handsome speckled clam of delicate flavor, which contained milk white pearls of exquisite luster and perfectly spherical."

In the 42 years since Mr. Bishop wrote these words the picture has not improved any. Sugar and pineapple fields on steep lands bordering several large streams which drain into Pearl Harbor have deposited such vast quantities of mud that the Navy is obliged to do considerable dredging to remove it. Of course all sandy spots suitable for oysters or clams have long since disappeared.

Conservation measures on the land may someday be regarded as the most effective insurance yet devised by man against prolonged and damaging periods of scant rainfall.

Food for human consumption can be no healthier than the soil on which it grew.

Indeed, it has been stoutly contended that considerations of good human nutrition should begin with an examination of the soils on which our food is grown; that mineral-deficient soils ultimately produce mineral-deficient vegetables and milk; and that no amount of wisdom in the selection of a menu, or care in the preparation of food, can give nutritive qualities to food which was unable to find them in the first place in the soil.

To the extent that thorough going soil conservation work on the land is able to maintain and build healthy soil, so may it contribute to improved nutrition in far greater measure than we can now anticipate.

EDITOR'S NOTE.—The author is an agricultural engineer with the Corps of Engineers, U. S. Army. He was formerly with the Soil Conservation Service.

For REFERENCE

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SOIL CONSERVATION SERVICE

The Abolition of the Plow. Article by H. H. Bennett, Chief, Soil Conservation Service. (Reproduced from The New Republic, October 1943, by permission of the Editors.) mm.

Devices for Measuring Rates and Amounts of Run-off Employed in Soil Conservation Research. SCS–TP–51. Compiled for Latin American Trainees—not available for general distribution. July 1943. Processed.

Notes on Reservoir Silting and Suspended-Load Measurements in Idaho. Special Report No. 4. Soil Conservation Service. January 1943. mm.

Pasture Production and Utilization in Southwestern Wisconsin. Economic Research Office, Soil Conservation Service, La Crosse, Wis., with the cooperation of the Wisconsin Agricultural Experiment Station. May 1943. mm.

Saving the Rural Church through Soil Conservation. Address by Dr. T. S. Buie, Regional Conservator, Soil Conservation Service, Spartanburg, S. C., before the Rural Life Conference, Columbia, Miss. June 14, 1943. mm.

OFFICE OF INFORMATION
U. S. DEPARTMENT OF AGRICULTURE

Legume Cover Crops to Boost Production in the South. AWI–67. Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration. September 1943.

Sagebrush Burning: Good and Bad. Farmer's Bulletin No. 1948. Intermountain Forest and Range Experiment Station, Forest Service, January 1944. 10¢.[1]

Soybeans and Soybean Products as Food. Miscellaneous Publication No. 534. Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration. December 1943.

What Post-War Policies for Agriculture? The Farmer and the War: No. 7. Report of U. S. Department of Agriculture Interbureau and Regional Committee on Post-War Programs. January 1944.

STATE BULLETINS

Does Soil Conservation Pay? It Did Here. Bulletin No. 459. State Soil Conservation Committee, with the cooperation of the Soil Conservation Service, U. S. Department of Agriculture, and the Agricultural Experiment Station, the University of Wisconsin, Madison. March 1943.

Forest-Land Utilization in Nicholas and Webster Counties, W. Va. Bulletin No. 309. Agricultural Experiment Station, Morgantown, West Virginia, with the cooperation of the Bureau of Agricultural Economics, U. S. Department of Agriculture. July 1943.

Inspection of Commercial Fertilizers and Agricultural Lime Products. Bulletin No. 118, control series. Agricultural Experiment Station, Massachusetts State College, Amherst, Mass. September 1943.

Labor Saving through Farm Job Analysis. Bulletin No. 503. Agricultural Experiment Station, University of Vermont, Burlington, Vt. June 1943.

[1] From Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Land Cover in Relation to Water Control and Utilization in the Upper French Broad River Watershed. Bulletin No. 339. Agricultural Experiment Station and the Agricultural Extension Service, North Carolina State College, Raleigh, N. C., with the cooperation of the Tennessee Valley Authority. June 1943.

Maximum Wartime Production Capacity of New Jersey's Agriculture. State Agricultural College and Experiment Station, New Brunswick, N. J. July 1943. Processed.

Meeting Wartime Beef Production Goals. Circular No. C–112. Agricultural Experiment Station, Oklahoma A. & M. College, Stillwater, Okla. May 1943.

Need and Use of Boron for Alfalfa. Bulletin No. 501. Agricultural Experiment Station, University of Vermont, Burlington, Vt. June 1943.

Nitrate Production as Affected by Grain-Crop Residues on the Surface of the Soil. Research Bulletin No. 131. Agricultural Experiment Station, University of Nebraska, Lincoln, Nebr., with the cooperation of the Soil Conservation Service, U. S. Department of Agriculture. August 1943.

North Carolina Fights with Extra Food. War Series Bulletin No. 28. Extension Service, North Carolina State College, Raleigh, N. C. November 1943.

Organizing and Operating Bulloch County Farms to Meet War Needs. Bulletin No. 227. Georgia Experiment Station, Experiment, Ga., with the cooperation of the Bureau of Agricultural Economics, U. S. Department of Agriculture. October 1943.

Pasture Investigation: Tenth Report—The Effects of Fertilizers on Grazed, Permanent Pastures. Bulletin No. 245. Agricultural Experiment Station, University of Connecticut, Storrs, Conn. March 1943.

Peanut Production Possibilities in Georgia. Bulletin No. 228. Georgia Experiment Station, Experiment, Ga., with the cooperation of the Bureau of Agricultural Economics and Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture. October 1943.

Produce Your Own Nitrogen by Sowing Cover Crops. Bulletin No. 232. Extension Service, Rutgers University, New Brunswick, N. J. August 1942.

Raising Beef Cattle in North Carolina. Circular No. 268. Agricultural Extension Service, University of North Carolina, Raleigh, N. C., with the cooperation of the U. S. Department of Agriculture. September 1943.

Relation of Drouth and Grazing to North Dakota Range Lands. Bulletin No. 320. Agricultural Experiment Station, North Dakota Agricultural College, Fargo, N. Dak. February 1943.

Soybeans in Georgia. Circular No. 319. Agricultural Extension Service, Athens, Ga. April 1943.

Spreading Lime With Manure. Pamphlet No. 6. Agricultural Experiment Station, University of Vermont, Burlington, Vt. May 1943.

Supplementary Hay Crops. Circular No. 465. Agricultural Experiment Station, Rutgers University, New Brunswick, N. J. May 1943.

Utilization of Irrigable Land in the Reservation Area of Uinta Basin, Utah. Bulletin No. 303. Agricultural Experiment Station, Utah State Agricultural College, Logan, Utah, with the cooperation of the Bureau of Agricultural Economics, U. S. Department of Agriculture. March 1943.

Wartime Fertilizers for New Jersey. Circular No. 456. Agricultural Experiment Station, Rutgers University, New Brunswick, N. J. March 1943.

What Price for This Land? Bulletin No. 368. Agricultural Experiment Station, South Dakota State College, Brookings, S. Dak. June 1943.

Wheat and Barley Compared as Feeds for Swine. Bulletin No. 166. Agricultural Experiment Station, University of Nevada, Reno, Nev. October 1943.

"FOR YEARS TO COME"

Last month a brief announcement was made in SOIL CONSERVATION concerning the new two-reel, color-sound film being readied for release by the Department of Agriculture, "For Years to Come." It was explained that the photographer, Rodney B. Radford, made numerous trips to the Pennsylvania farm of Christian B. Musser, for the purpose of recording the faithful round-the-calendar story of soil conservation progress. The various sequences in the picture depict the actual move from the standard methods of yesterday to the standard methods of today.

Here are two selections from the numerous "stills." They jump the months from late winter activity on a busy, conservation-minded farm to the bounteous rewards of a smiling harvest. They dramatize in miniature the brawny, brainy blows that American farmers are striking today for the freedom that is being implemented in large part by food. Soil conservation on the Musser farm, as on other farms from coast to coast, is vastly increasing production of war-needed crops while at the same time permanently safeguarding the productive lands for tomorrow's soldiers of peace.—THE EDITOR.

Front cover photograph taken in the field by Richard W. Hufnagle, Soil Conservation Service, Nebraska.

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